

CLAIMS

1. A method of estimating the mean pressure in a compressible fluid strut, the strut forming a portion of an active suspension system for a vehicle, the active suspension system including a motor having a crankshaft driving a cylinder, the cylinder being responsive to flow demands to deliver or remove fluid in the strut, the method comprising the steps of:

providing a database of values for mean pressure variation corresponding to a specific combination of motor speed and flow demand

determining the flow demand;

determining a speed of the motor;

selecting the mean pressure variation corresponding to the determined combination of motor speed and flow demand;

updating the estimation of strut mean pressure with the selected mean pressure variation.

2. The method of claim 1, further comprising the step of determining the period of the mean pressure variation based on the motor speed.

3. The method of claim 2, further comprising the step of determining a mean pressure rate based on the mean pressure variation and the period.

4. The method of claim 3, wherein the mean pressure rate equals the mean pressure variation divided by the period.

5. The method of claim 3, wherein the updating step includes updating the estimation of strut mean pressure with the mean pressure rate over a length of time equal to the period.

6. The method of claim 3, wherein the estimation of strut mean pressure is updated according to the equation $SMP_c = SMP_p + MPR$, where SMP_c is current strut mean pressure, SMP_p is prior strut mean pressure and MPR is mean pressure rate.

7. The method of claim 3, wherein the estimation of strut mean pressure is updated according to the equation $SMP_c = SMP_p + \lambda * MPR$, where SMP_c is current strut mean pressure, SMP_p is prior strut mean pressure, λ is the efficiency of the motor, and MPR is mean pressure rate.

8. The method of claim 3, wherein the estimation of strut mean pressure is updated according to the equation $SMP_c = SMP_p + \lambda * MPR * (1+a)$ for the first half of the period, and the equation $SMP_c = SMP_p + \lambda * MPR * (1-a)$ for the second half of the period, where SMP_c is current strut mean pressure, SMP_p is prior strut mean pressure, λ is the efficiency of the motor, MPR is mean pressure rate, and a is a predetermined constant to allow adjustment of the estimation.

9. The method of claim 1, wherein the database includes values for mean pressure variation corresponding to a specific combination of motor speed, temperature and flow demand, and further comprising the step of determining a temperature, and wherein the selecting step includes selecting the mean pressure variation corresponding to the determined combination of motor speed, temperature and flow demand.

10. The method of claim 1, wherein the updating step includes determining a time delay and delaying the update for the time delay.

11. The method of claim 1, the active suspension system including two cylinders being responsive to flow demands to deliver or remove fluid in the strut, and wherein the flow demand is determined for each of the two cylinders.

12. The method of claim 11, wherein the selecting step includes selecting the mean pressure variation corresponding to the determined combination of motor speed and the two flow demands.

13. An active suspension system for a vehicle comprising:
- a motor having a crankshaft
 - a cylinder driven by the crankshaft, the cylinder having high pressure and low pressure valves,
 - a compressible fluid strut fluidically connected to the cylinder for increasing or decreasing the pressure in the strut;
 - a vehicle dynamics controller generating a requested pressure for the strut;
 - a device control for regulating the pressure in the strut, the device control including a valve controller, a mean pressure estimator and a flow demand creator, the valve controller regulating the high and low pressure valves of the cylinder, the mean pressure estimator providing an estimation of the mean pressure in the strut, the flow demand creator sending flow demand signals to the valve controller based on the difference between the requested pressure and the estimation of current mean pressure; and
- wherein the mean pressure estimator receives data on the speed of the motor and the flow demand signals, determines a mean pressure variation corresponding to the motor speed and flow demand, and updates the estimation of strut mean pressure with the mean pressure variation.
14. The active suspension system of claim 13, further comprising a database having mean pressure variation values corresponding to specific combinations of motor speed and flow demand.

15. The active suspension system of claim 13, further comprising a database having mean pressure variation values corresponding to specific combinations of motor speed, temperature and flow demand.

16. The active suspension system of claim 15, wherein the mean pressure estimator receives data on the temperature, and wherein the mean pressure estimator determines a mean pressure variation corresponding to the motor speed, temperature and flow demand.

17. The active suspension system of claim 13, wherein the mean pressure estimator determines the period of the mean pressure variation based on the motor speed.

18. The active suspension system of claim 17, wherein the mean pressure estimator determines a mean pressure rate based on the mean pressure variation divided by the period.

19. The active suspension system of claim 18, wherein the mean pressure estimator updates the estimation of strut mean pressure with the mean pressure rate over a length of time equal to the period.

20. The active suspension system of claim 18, wherein the estimation of strut mean pressure is updated according to the equation $SMP_c = SMP_p + \lambda * MPR$, where SMP_c is current strut mean pressure, SMP_p is prior strut mean pressure, λ is the efficiency of the motor, and MPR is mean pressure rate.